

**INTERNATIONAL BOUNDARY AND WATER COMMISSION**  
**UNITED STATES AND MEXICO**

**El Paso, Texas**  
**May 11, 2004**

**JOINT REPORT OF THE PRINCIPAL ENGINEERS CONCERNING THE ADOPTION  
OF A CRITERIA FOR THE CALCULATION OF CONVEYANCE LOSSES  
ASSOCIATED WITH TRANSFERS TO THE UNITED STATES OF MEXICAN  
WATERS STORED AT AMISTAD AND FALCON INTERNATIONAL DAMS**

**To the Honorable Commissioners  
International Boundary and Water Commission  
United States and Mexico  
El Paso, Texas/Ciudad Juárez, Chihuahua**

**Sirs:**

We respectfully submit this joint report of the Principal Engineers which proposes the adoption of a criteria for the calculation of the losses associated with the transfers, to the United States, of Mexican waters stored at the Amistad and Falcon International Dams, for the replacement of the water volumes owing to that country from the measured Mexican tributaries to the Rio Grande consistent with the stipulations of the 1944 Water Treaty and Minute 234 entitled: "Rio Grande Waters Assigned to the United States from the Conchos, San Diego, San Rodrigo, Escondido and Salado Rivers and the Arroyo de las Vacas," signed December 2, 1969.

**BACKGROUND**

In accordance with the agreements in Washington at the end of 2002 and early January 2003, on January 25, 2003, a volume of 159.8 Mm<sup>3</sup> was transferred to the United States: 127.8 at Amistad Dam and 32 Mm<sup>3</sup> at Falcon Dam. As an alternative to release of waters from Rio Conchos reservoirs, on March 29, 2003 another transfer of 68.0 Mm<sup>3</sup> was made at Amistad Dam, with the understanding that the corresponding losses would be deducted from this volume.

Before this recent drought, the Commission had not been confronted with the need to make these types of transfers. As a result, Mexico proposed that the conveyance losses associated with these reservoir transfers be credited to Mexico in addition to the volumes actually transferred in the reservoirs.

The above was reiterated at the binational meeting to sign Minute 307 on March 16, 2001, and confirmed in letter No. LAE 00601/01, dated March 22, 2001. In letter No. US 115/01, dated May 3, 2001, the United States Section was in agreement with the principal of crediting conveyance losses to the corresponding country.

**PROBLEM**

Before the recent drought, there had not been any transfers of this nature of Mexican waters at the Amistad and Falcon International Dams, and notwithstanding that Minute 234 does

consider them a means of replacing missing volumes, it does not mention the losses which necessarily will arise in conveying these volumes of water to the said dams and this is the reason why they are not considered in the water accounting procedures. On the other hand, in view of the water scarcity conditions prevailing in the last few years, this issue has become very controversial and we have not reached a formal agreement in this regard.

Although the Rio Grande water accounting procedure considers the estimation of conveyance losses in the channel of the river due to surface evaporation of the exposed water, and due to evapo-transpiration of the vegetation on both banks and watered from the same river, this Commission does not have an established criteria for the calculation of the losses to be applied to the volumes stored at the international dams which have been transferred. The 111 Mm<sup>3</sup> assigned to the United States on June 29, 2002, whose losses agreed to in Minute 308 were 35.5 Mm<sup>3</sup>, were credited without the establishment of an agreed-upon procedure. Likewise, a storage transfer of 231.28 Mm<sup>3</sup> assigned to the United States in Amistad on January 10, 2004 with losses of 77.093 Mm<sup>3</sup> agreed to by the Commission was credited without the establishment of an agreed-upon procedure.

It is important to note that the determination of the losses in the river is complex since these depend on various factors, such as: variations in climatic conditions, the type of channel material, variations over time and space of the flow conveyed in the river, among other factors which cause great variation in the data considered in the accounting of the estimated losses, and as such, make it more difficult to achieve consensus, for specific cases such as the mentioned above, concerning the periods which should be utilized for the calculation of the losses.

In summary, the absence of an approved criteria in this international organization for the determination of conveyance losses in the cases of water transfers from the international dams has made more difficult and delayed the execution of the said approved and accomplished transfers.

### **CURRENT SITUATION**

Applying the recommended procedure for determining conveyance losses for the transfer of the 159.8 Mm<sup>3</sup> on January 25, 2003 (24.8% at Amistad, and 2% at Falcon), the monthly data for October 2000 thru September 2002 was utilized. Considering the great variation in time and space affecting the losses, we considered it appropriate to calculate the losses for each particular case as a function of the flows and the losses calculated in the final monthly water accounting for the months prior to the water transfer being under review, considering the identification of the losses for the different months of the year, and associating the application with the months in which the contribution of waters allotted to Mexico from the measured tributaries were conveyed or could have been conveyed in the Rio Grande to accumulate an equivalent volume of storage in the international dams.

Based on this, the percentages and loss volumes were calculated for the water transfers presented in the following table:

Total Volume Credited		Transfer Volume and % Loss by Dam				Total Losses
Period	Volume	Amistad		Falcon		
	Mm3	Mm3	%	Mm3	%	Mm3
March-April 2000	245.025	145.0	33.6	25.0	6.2	75.025
January 2003	202.6	127.8	24.8	32.0	2.0	42.8
March 2003	68.0	63.58	6.5	0.0	0.0	4.42
September 2003	25.0	18.4	26.4	0.0	0.0	6.6
TOTALS	540.625	354.78		57.0		128.845

Also, we saw the need to evaluate the possibility of conducting additional analyses with the monthly historical flow and loss records in the final monthly accounting which could permit the establishment of a more precise criteria for the determination of the losses associated with the transfers of waters from the international dams, which should be included in the Rio Grande water accounting. The above would not have retroactive impact on the water accounting results already agreed to, and would be applied as of the date of its agreement within the IBWC.

In light of the above results and given the need for a mutual criteria for the estimation of the losses to be credited in favor of Mexico for each water transfer to the United States from Amistad and Falcon International Dams, we propose the initial adoption of the following criteria for the estimation of the losses associated with the transfers of Mexican waters from the international dams:

#### **PROPOSED CRITERIA**

1. Calculate the losses for each specific case in light of the spatial and temporal variability of the same. This procedure would be appropriate for determination of losses for past and future transfers.
2. Utilize in the loss calculations, the data regarding total contributions to the Rio Grande from the measured Mexican tributaries, the average flows and the total conveyance loss

for each reach of the river adopted in the final monthly water accounting of this Commission.

3. Utilize the data for the months prior to the month in which the transfer was authorized, and these would be the months in which the Mexican volume of the contributions from the measured Mexican tributaries (using final monthly water accounting data) would have been sufficient to store the transferred water at each international dam.
4. Calculate, for each reach of the river adopted in the procedure for the final water accounting, the loss in volume which corresponds to the contribution from each measured tributary from its confluence with the Rio Grande to the international dam located downstream from the same.
5. Based on the above point, determine the percentage of total loss between Ojinaga, Chihuahua (Presidio, Texas) and Amistad Dam, and between Amistad Dam and Falcon Dam. Depending on the dam from which the transfer is made.
6. Propose modifications to this criteria which will improve it, by means of periodic revisions and based on the modernization and expansion of the water measurement systems.

### **RECOMMENDATIONS**

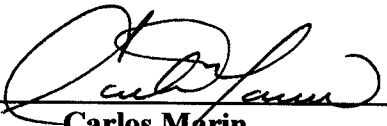

1. Approve and assign to Mexico the loss volumes for the transfers presented in the table included in the present report.
2. Approve the criteria proposed for the estimation of losses associated with the transfers of Mexican waters to the United States from the Amistad and Falcon International Dams.
3. In the short and mid-terms, we recommend:
  - Conduct an analysis of the variability in space and time of the conveyance losses which have been estimated in the water accounting procedure, based on the hydrometric data and the historical results of the same to define the monthly ranges of variation as a function of the flows in the river.
  - Conduct periodic studies in order to update the tables for the estimation of evaporation and evapo-transpiration as a function of the river channel surface area
  - Exposed to these phenomena, since the current channel conditions and vegetation cover on its banks could be different from those in existence when these were first formulated.
  - Based on the above analysis, determine the need to carry out a study to establish a general criteria for the determination of the total river conveyance losses.

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- Create a binational database with basic information and the resulting final monthly water accounting data.

**Respectfully,**

  
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**Carlos Marin**  
**Principal Engineer**  
**United States Section**  
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**Gilberto Elizalde Hernandez**  
**Principal Engineer**  
**Mexican Section**